Rec. zool. Surv. India: Vol. 122(3)/287–290, 2022
DOI: 10.26515/rzsi/v122/i3/2022/167009

ISSN (Online) : 2581-8686
ISSN (Print) : 0375-1511

Description of *Varunella coronifera* in India (Bryozoa: Phylactolaemata)

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Abstract

Bryozoans are among the most common benthic filter feeding invertebrates in fresh water. It is estimated that the number of species worldwide to be 94, but that number continues to rise as more regions are explored. One Indian species has remained a mystery. *Varunella coronifera* Wiebach, 1974 was fully described and illustrated, but the published account included no information about where, when, or by whom it was collected, nor was there any mention of a repository. Some years later the species was discovered second time and without being recognized, was given a different name. In this paper we describe two new discoveries of *Varunella coronifera* and put to rest the taxonomic confusion.

Keywords: Bryozoa, India, Phylactolaemata, *Varunella coronifera*

Introduction

Bryozoans are among the most common benthic filter-feeding invertebrates in freshwater. Also known as "moss animals," they grow as colonies attached to submerged substrata, such as plants, rocks, wood, and plastic (Swami *et al*., 2016). Several recent studies have highlighted the important role played by freshwater bryozoans in passing nutrients and energy through the aquatic community (Wood, 2018, Nimtim *et al*., 2021).

Historically, the Zoological Survey of India has played a major role in bryozoan taxonomy. The first director, Nelson Annandale, published 27 articles on freshwater bryozoans, describing nine new species and three new genera (Kemp, 1925). At least 27 species are now documented from India, which is more than any other country or region (Wood, unpublished).

The largest taxonomic group of freshwater bryozoans is Family Plumatellidae, in which colonies are often very similar in appearance (Rao, 1992). Species are distinguished primarily by morphological details of the asexually produced dormant bodies, called statoblasts (Geimer and Massard, 1985). Statoblasts that are freely released into the water are called "floatoblasts," while those attached to the substratum are "sessoblasts". Both types have important taxonomic value (Wood, 2005).

Until recently one Indian species has been enigmatic. *Varunella coronifera* Wiebach, 1974 was fully described and illustrated, but the published account included no information about where, when, or by whom it was collected, nor was there any mention of a repository. Some years later the species was discovered a second time and, without being recognized, was given a different name. More recently a third specimen has been found. In this paper, we describe the two newest discoveries of *Varunella coronifera* and put to rest the taxonomic confusion.

Materials and Methods

Varunella coronifera was found independently at three sites in Maharashtra and Madhya Pradesh. One specimen was collected by one of us (NN) in a shallow region of Mombata reservoir, 18 km NW of Aurangabad, MH (19°57'N, 75°15'E). It consisted of a single isolated sessoblast attached firmly to a submerged plastic substratum without any associated colony structure. The specimen is currently deposited at the Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MH), India.

A second specimen was collected in 1987 by the late Professor K. S. Rao of Vikram University in Ujjain, M.P.

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Article Received on: 10.11.2020 Accepted on: 10.02.2022

from the Kshipra River 3 km south of the university campus, at 23.1290° N, 75.7934° E. Colonies appear to have been scraped free from the substratum. At the time, Rao identified the species as *Hyalinella diwaniensis* Rao *et al*., 1985. A third specimen, also from Dr. Rao's collection, is undated and labelled only "Indore". These materials were preserved in ethyl alcohol and donated to one of us (TW). A portion of Rao's Indore material has now been deposited with the ZSI in Kolkata, No. ZSI-HQ/GNC/ZEV7546/7, including multiple floatoblasts and sessoblasts.

The sessoblast from Mombata Reservoir was removed from the substratum with a scalpel by gently scraping from all sides to avoid damage. In the laboratory it was fixed and preserved in 70% ethyl alcohol, then examined and photographed through a dissection microscope. For examination with scanning electron microscopy the sessoblast was cleaned by vigorous shaking in 0.1N sodium hexametaphosphate (Wood, 2001). The sessoblast was then mounted on an aluminium stub, sputtered with gold, and examined with FESEM (FEI Nova NanoSEM 450). Sessoblast dimensions were captured in SEM images.

Statoblasts from the Rao collection were measured from calibrated photos of whole floatoblasts as well as individual floatoblasts valves. The valves were separated by exposure to a hot, saturated NaOH solution (Wood, 2005). All measurements were taken with the floatoblasts in deionized water to avoid the shrinkage that often results from dehydration.

Results

Class PHYLACTOLAEMATA Allman, 1856
Order PLUMATELLIDA Allman, 1856
Family PLUMATELLIDAE Allman, 1856 Genus ***Varunella*** Wiebach, 1974
Varunella coronifera Wiebach, 1974

Description: Wiebach (1974) described the colony as having a body wall that is soft, unsclerotized, thick and firm; the colony growing close to the substratum, with branches fused near the centre but dendritic around the periphery; zooids arising from conical protrusions in the basal tubules. Wiebach's Figures 6 and 7 show floatoblasts that are broadly oval with sides nearly parallel along the midpoint; both dorsal and ventral fenestrae are small and nearly circular, their lengths no more than a third of the overall statoblast length; the ventral fenestra finely tuberculated and considerably smaller than the underlying capsule. Floatoblast dimensions were given as 0.382-0.468 mm long and 0.272-0.374mm wide. Sessoblasts were described as having two forms: in one the frontal valve is fully covered by tubercles, in the other, the tuberculation is interrupted by a circular formation of irregular lumps halfway between the sessoblast centre and the annulus; the annulus in both sessoblast forms was reticulated; dimensions described as 0.382-0.448 mm long and 0.272-0.374 mm wide.

Although the recent specimen from Mombata Reservoir consists only of a single sessoblast, the morphology is highly unusual and matches one of the sessoblast forms described by Wiebach (1974). The frontal valve bears distinct tubercles and a central eruption of lumps arranged roughly in a circle (Figure 1a, b). The annulus is clearly reticulated. The sessoblast measures 274 µm long and 222 µm wide.

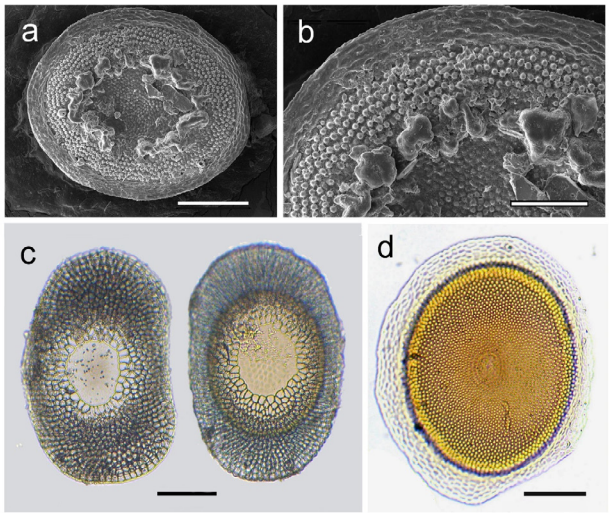

Figure 1. Statoblasts from recent collections of *Varunella coronifera*. **(a)** Sessoblast from Mombata Reservoir showing unique lumps on the frontal valve, scale bar = 100 µm; **(b)** Magnified view of the same sessoblast, scale bar = 50 µm; **(c)** Floatoblast valves from Kshipra River specimen, with dorsal valve on the left, scale bar = 100 µm; Sessoblast from the Kshipra River specimen, showing pattern of tuberculation and lacking the lumpy feature; scale bar = 100 µm.

In Rao's material, the thick body wall and fused basal branches of the colony are clearly evident. There are no internal septa and no evidence of external raphe. Floatoblast morphology matches that described by Wiebach (1974) (Figure 2a). Many sessoblasts lack the central lumps, but the tubercles are prominent, conforming to one of the forms described by Wiebach (1974) (Figure 2b). Statoblast dimensions from the Kshipra material are presented in Table 1.

Table 1. Statoblast dimensions from the Kshipra River specimens of *Varunella coronifera*. Standard deviations are expressed in parentheses

Feature	Mean dimensions (µm)	No.of specimens
Floatoblasts		
Overall length	436 (13.5)	9
Overall width	267 (13.3)	9
Dorsalfenestra length	102 (15.9)	4
Dorsal fenestra width	52 (19.4)	4
Ventral fenestra length	141 (10.6)	8
Ventral fenestra width	119 (12.6)	8
Sessoblast		
Overall length	334 (15.1)	4
Overall width	245 (14.6)	4

Discussion

As with most freshwater bryozoans, the most important identifying features are with the statoblasts. In the floatoblast small dorsal fenestrae are seen in many species, but the small ventral fenestra in *V. coronifera* is an unusual feature unknown in any other species. In the sessoblast the lumpy eruption on the frontal valve is also unique. These features match the photographs in Wiebach's (1974) original description and leave little doubt as to the identity of these recent specimens.

While we identified Rao's 1987 specimen from the Kshipra River as *Varunella coronifera*, Rao had labelled the material as *Hyalinella diwaniensis*, a species that he himself had described from Chirola Pond Rewa and Gandhisagar Reservoir, Mandsaur District, M.P. (Rao *et al*., 1985). In fact, the original colony description of *H. diwaniensis* is similar to that of *V. coronifera.* Notably, however, the floatoblast length in *H. diwaniensis* is described as 0.61 to 0.70 mm, which is unusually large, and certainly much larger than floatoblasts of *V. coronifera* from the Kshipra River.

Regarding *H. diwaniensis*, Rao had set aside holotypes and paratypes of the species, but these have apparently been lost. There remains only the published account, including several photos of the colony and floatoblasts. Floatoblast dimensions, together with the general shape, strongly suggest that this species is synonymous with *Hyalinella lendenfeldi* (Ridley, 1886), which is known to occur in India (Swami *et al*., 2016). Elsewhere *H. lendenfeldi* has been reported from Thailand (Wood et al., 2006), Cambodia (Hirose & Mawatari, 2007) and Australia (Ridley, 1886). An updated description of *H. lendenfeldi* is given by Wood et al., (2006).

We conclude that (1) Specimens from Mombata Reservoir, the Kshipra River, and Indore are identical to *Varunella coronifera* as described by Wiebach (1974); and (2) *Hyalinella diwaniensis,* as described by Rao *et al*., (1985) is likely to be synonymous with *Hyalinella lendenfeldi* (Ridley, 1886), although without any type material of the former species, this can never be fully verified.

Acknowledgements

The authors are thankful to Dr. Kalyan B. Shejule, Head of Department, Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MH), India for providing the laboratory facilities. The authors are also thankful to Central Facility Centre, Savitribai Phule Pune University, Pune (MH), India for providing FE-SEM facilities, and to C. Raghunathan at the ZSI in Kolkata for collection assistance. Financial support to NN was provided by Dr. Babasaheb Ambedkar Research and Training Institute (BARTI, Pune, India).

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